Precast Concrete Bridge Decks

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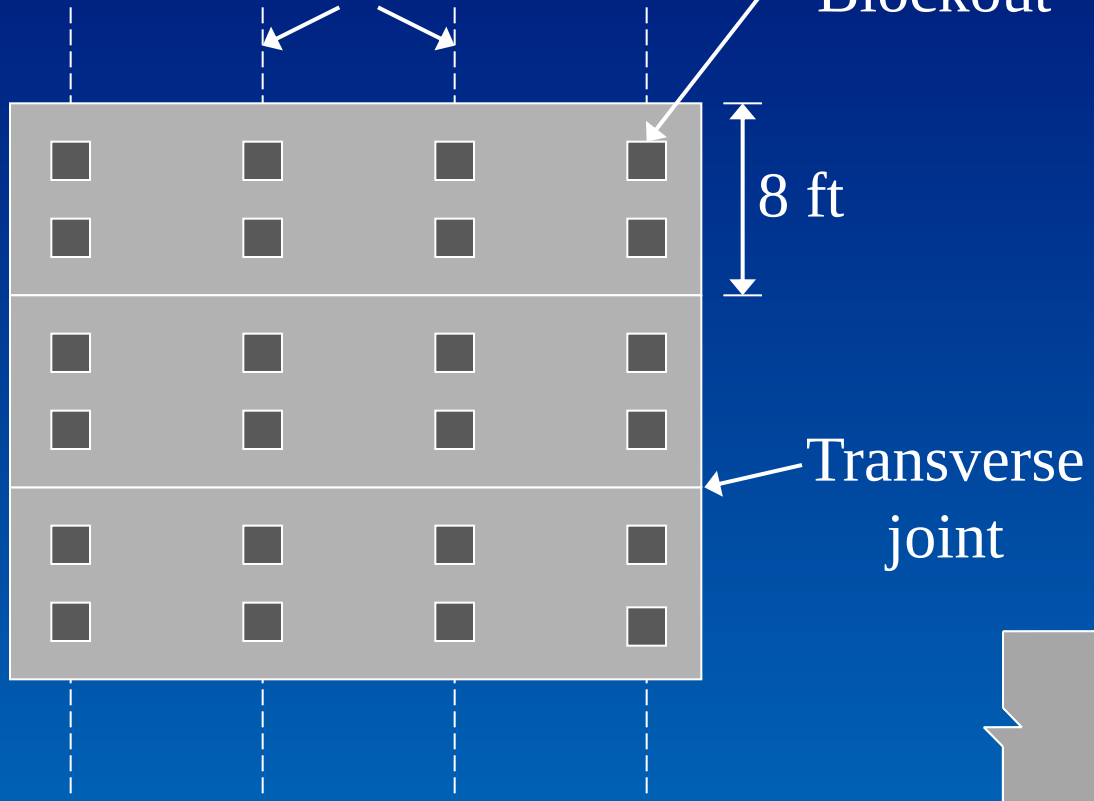
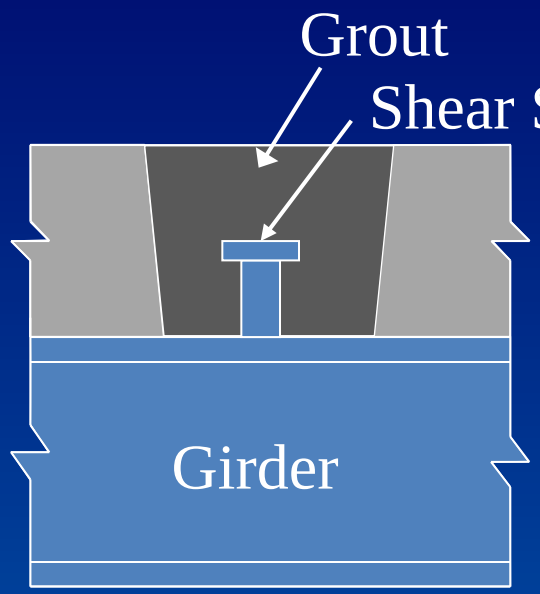
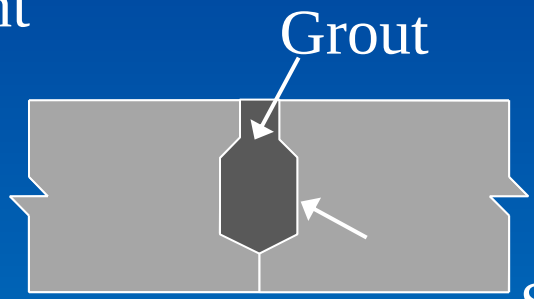
Full-Depth Precast Deck Panels



Plan



Elevation



Elevation

Benefits

- Quality control
- Construction without formwork
- Speed of construction

Extended New England System

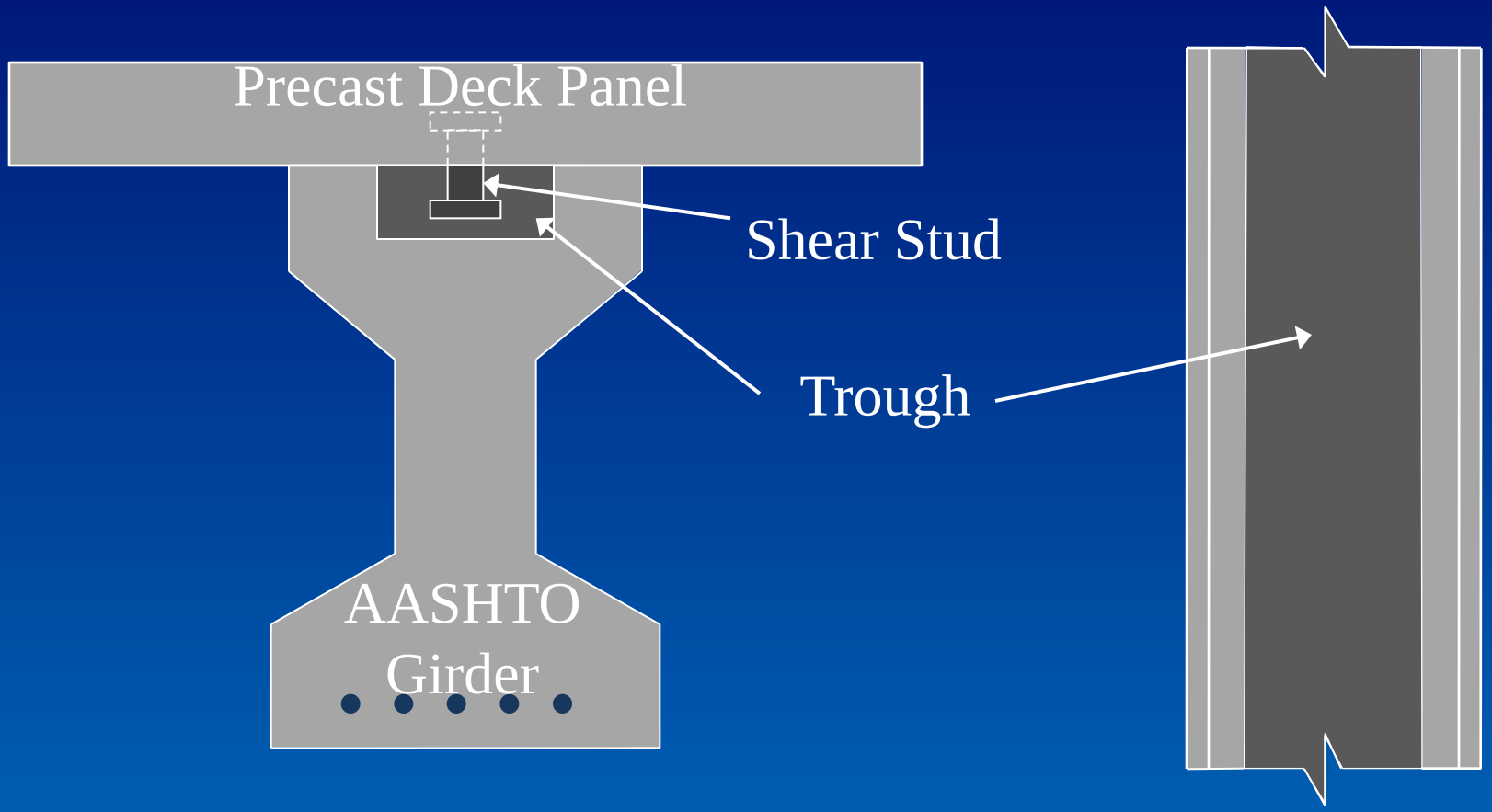
Limitations

- Full-depth penetrations of the deck panel
  - Shrinkage cracking
- Use of rapid setting grout material
  - Not readily available
  - Difficult to place

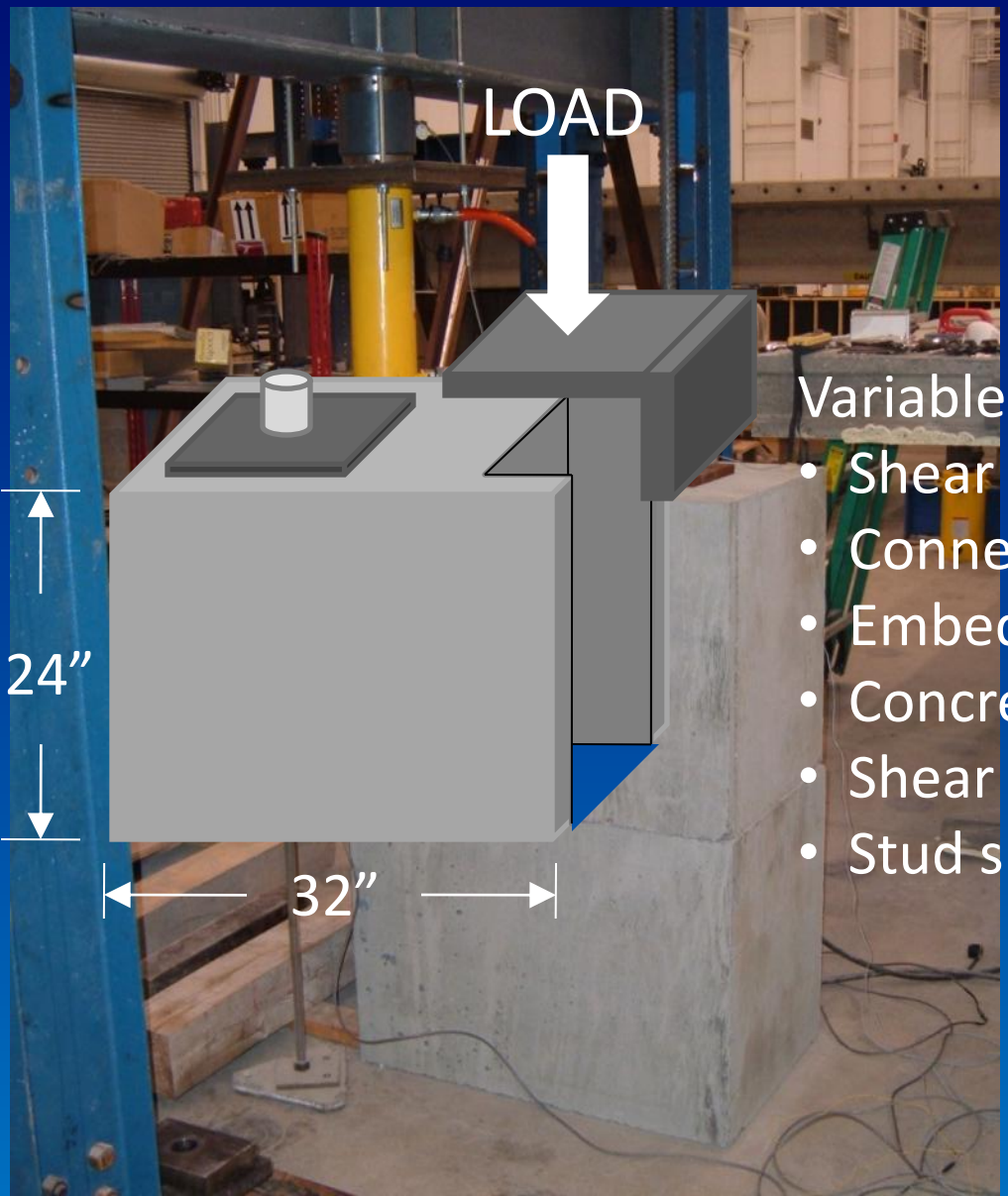
Research Objective

- Improve durability
  - Minimize deck penetrations
- Improve constructability

Panel-to-Girder Connection



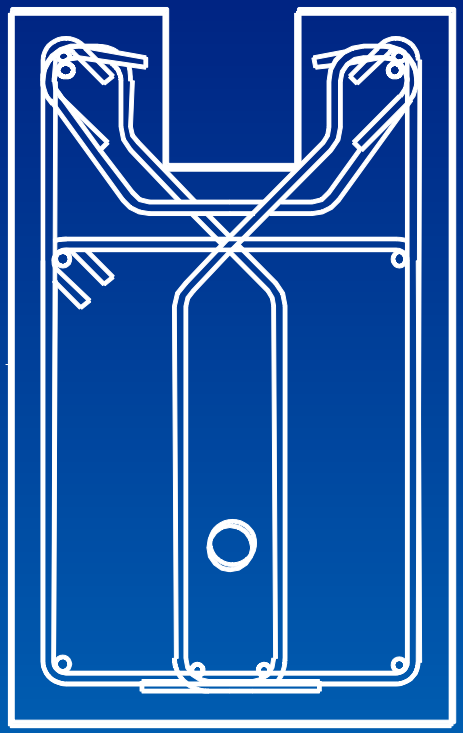
Test Specimen

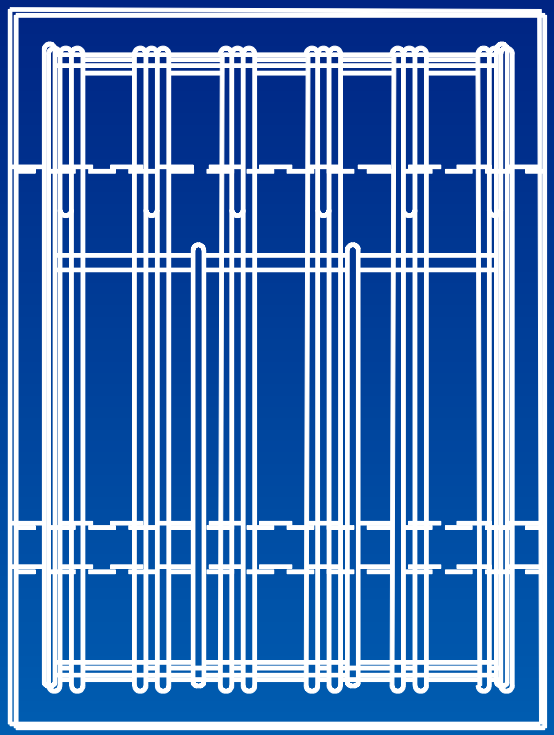


Variables

- Shear connector
- Connection type
- Embedment
- Concrete strength
- Shear keys
- Stud spacing

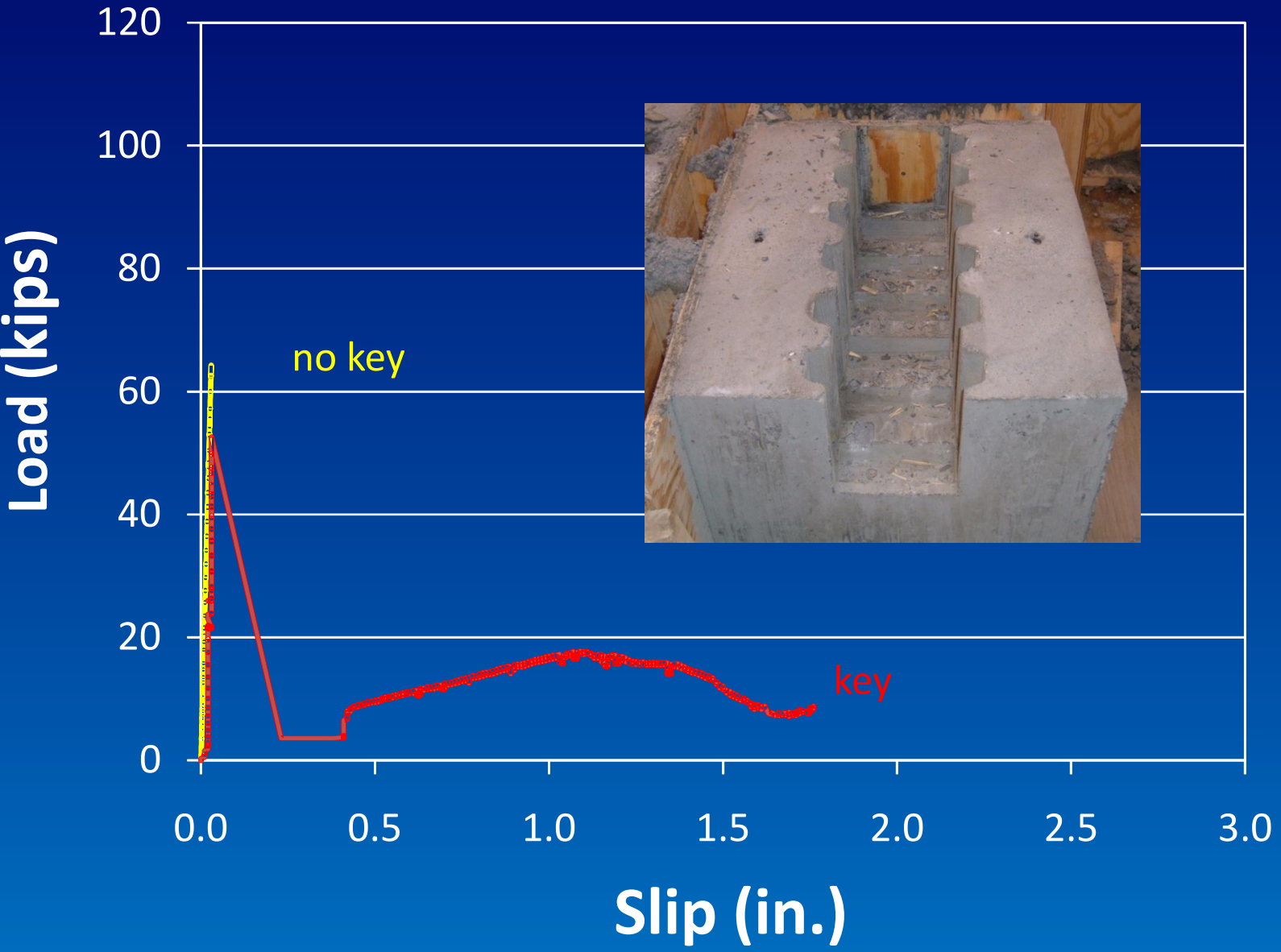
Group 1





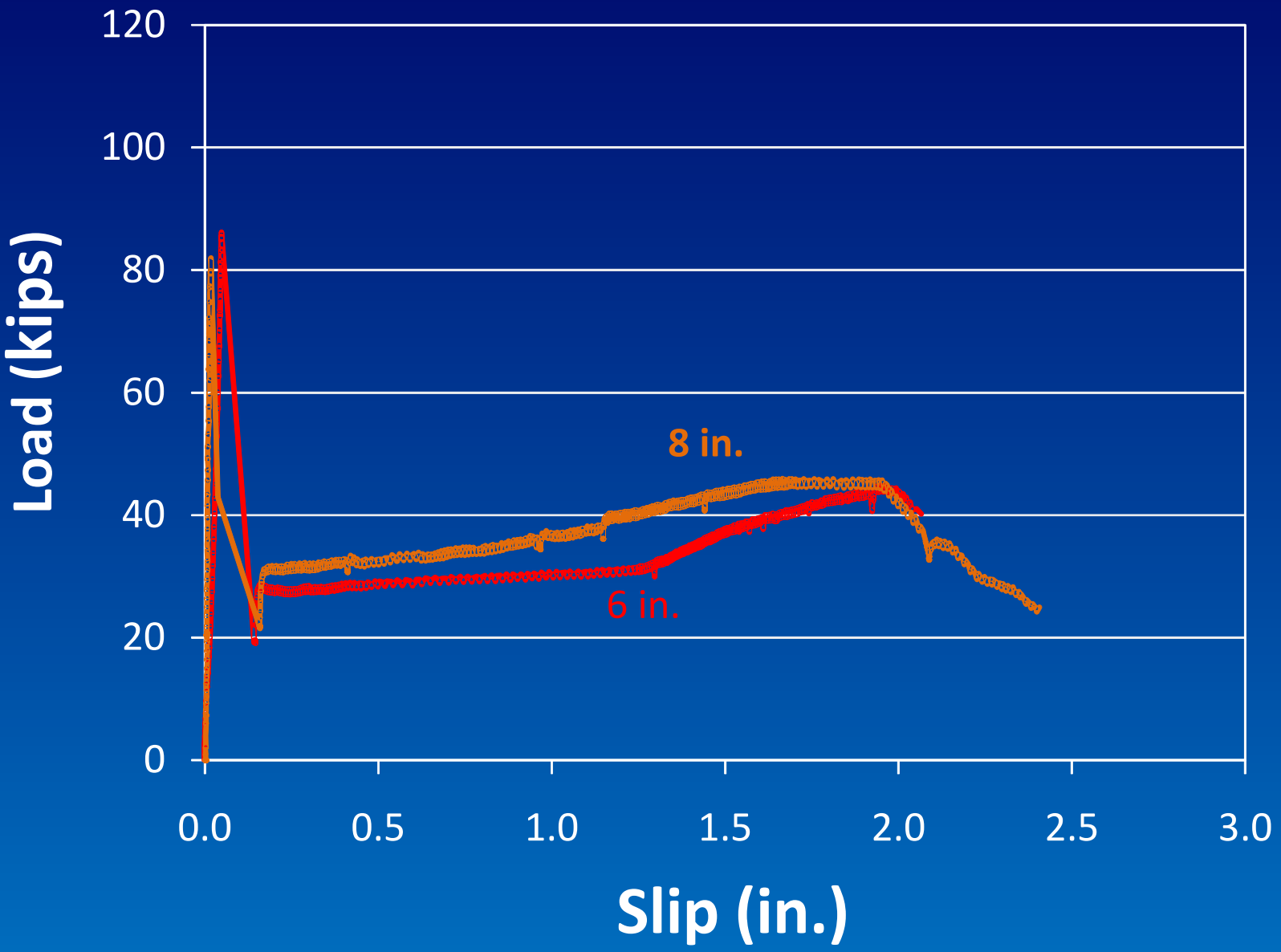
Group 1

Influence of keys

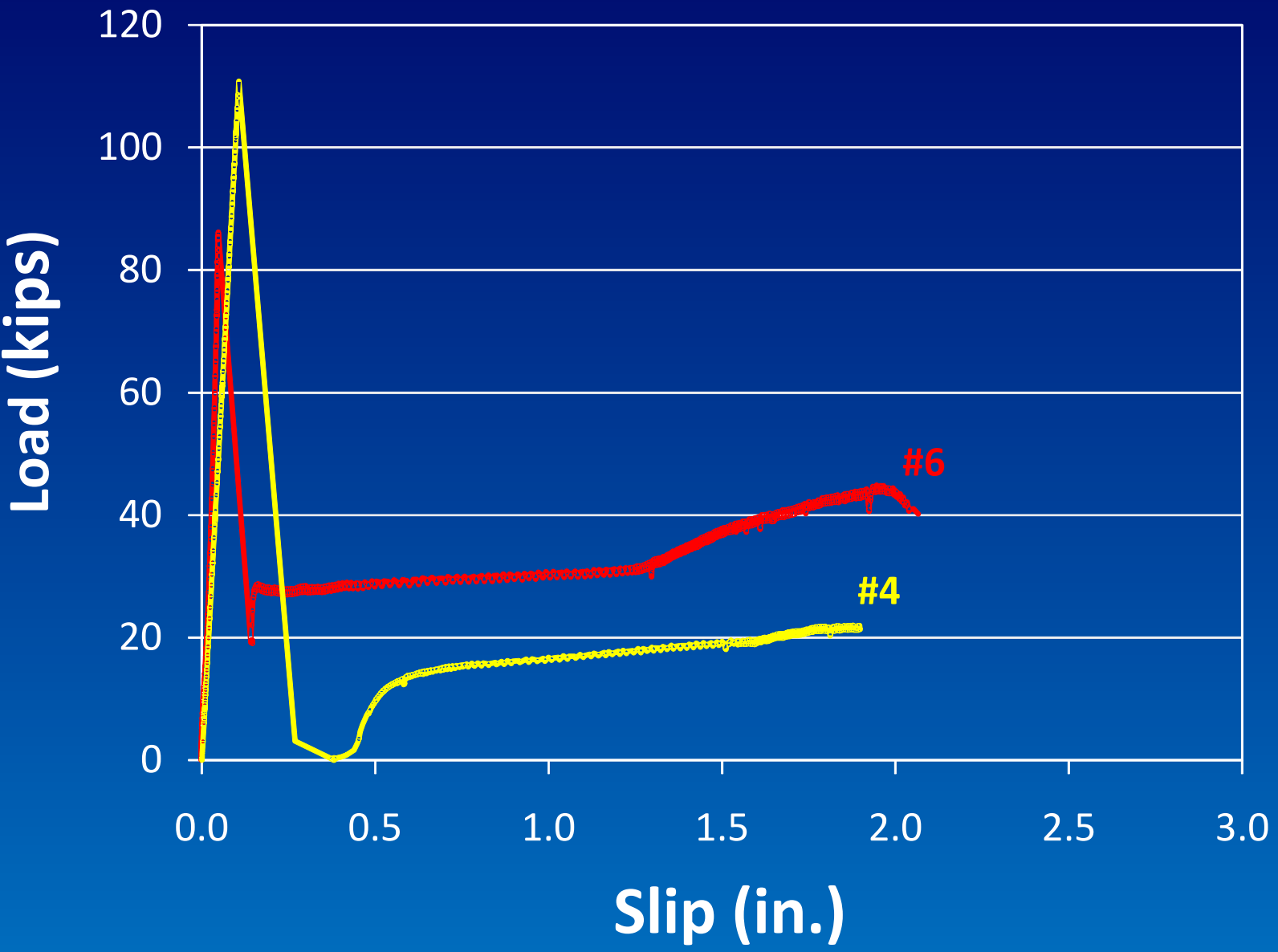


Failure: Keyed

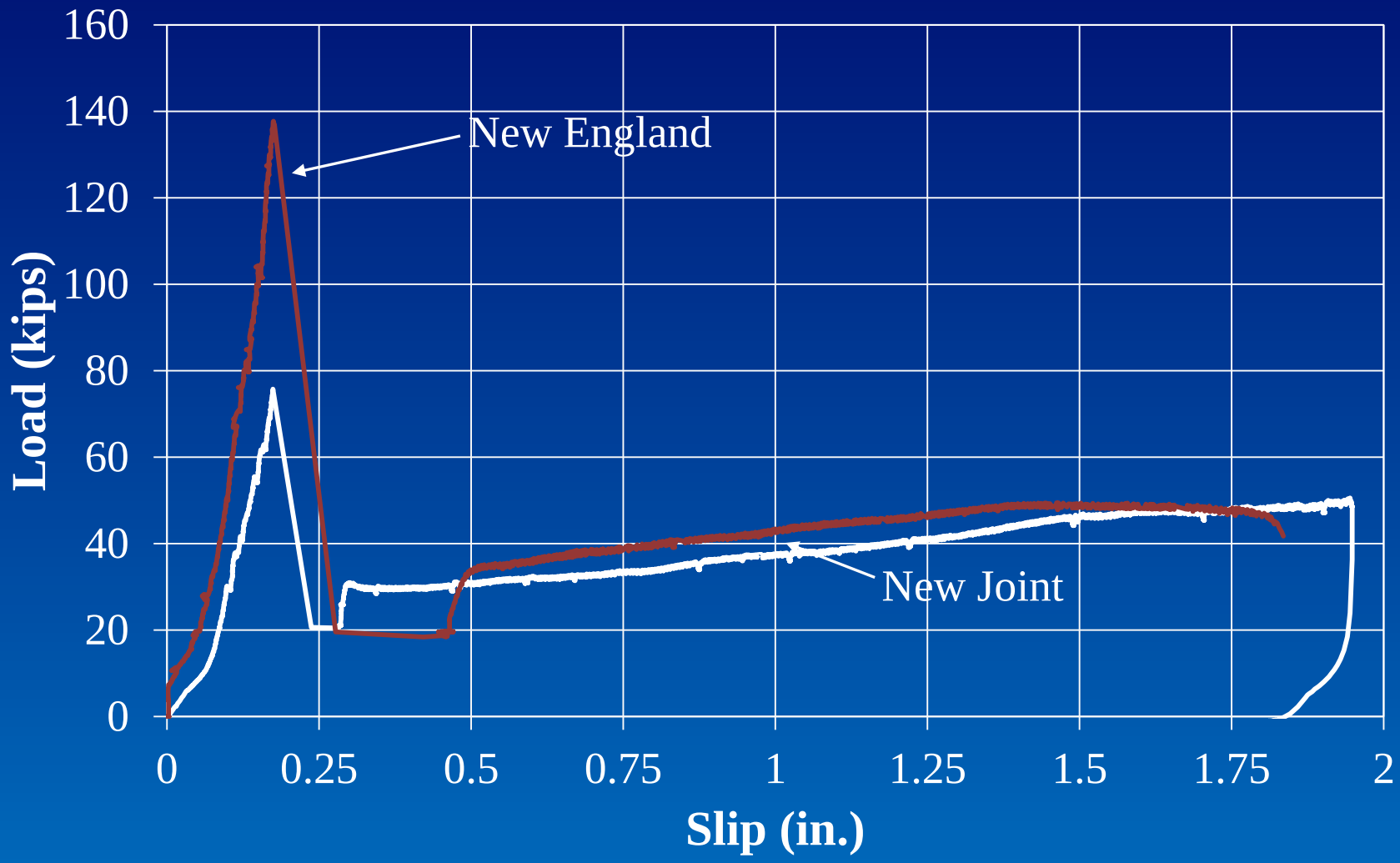
Influence of embedment



Influence of stud size

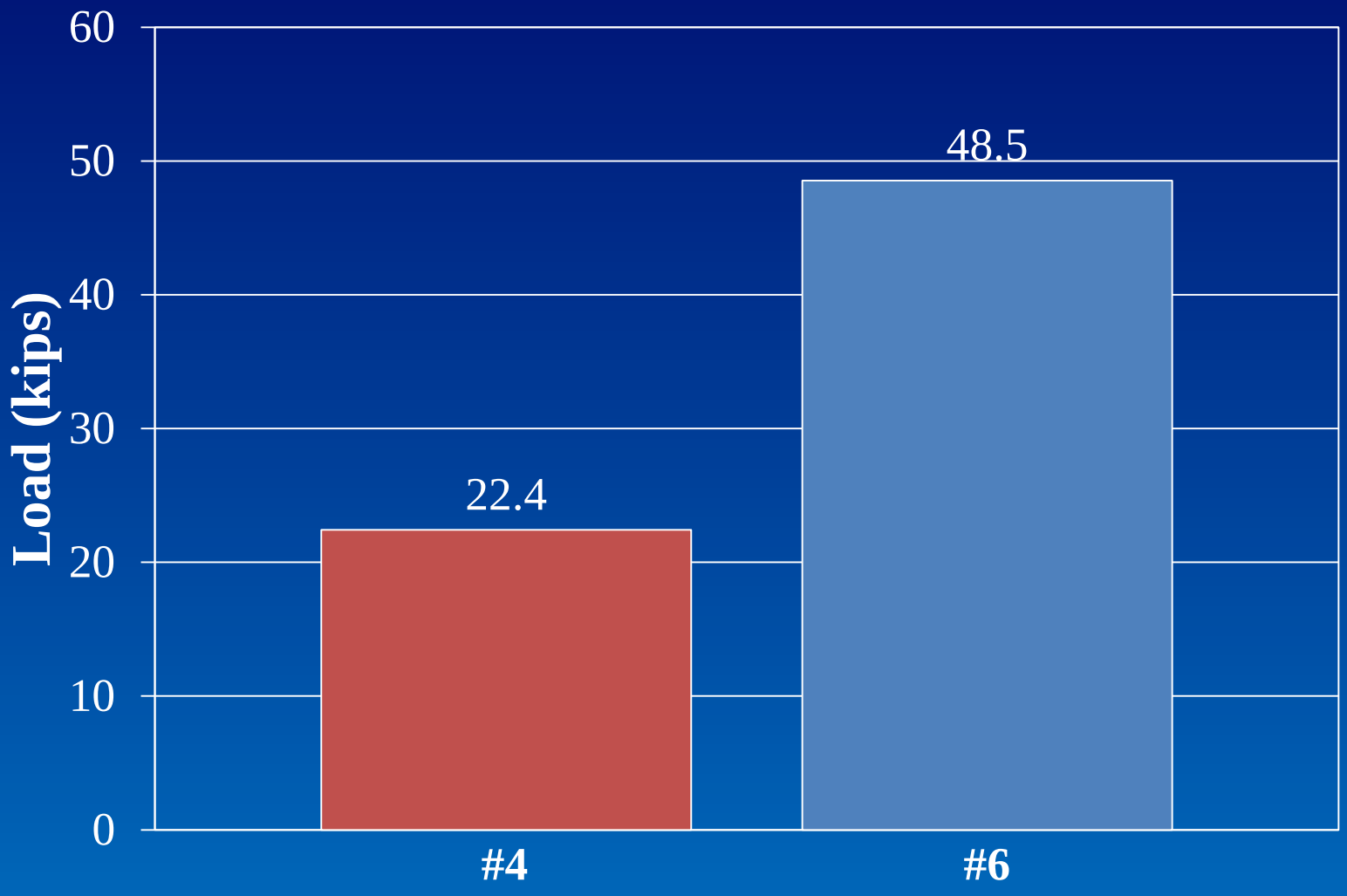


Joint Detail



Failure: New England

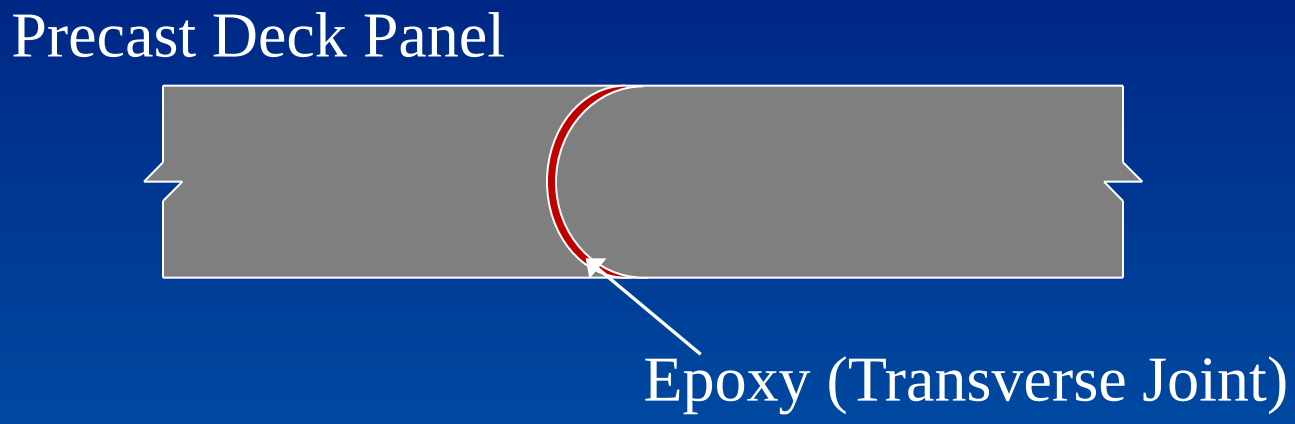
Stud Strength



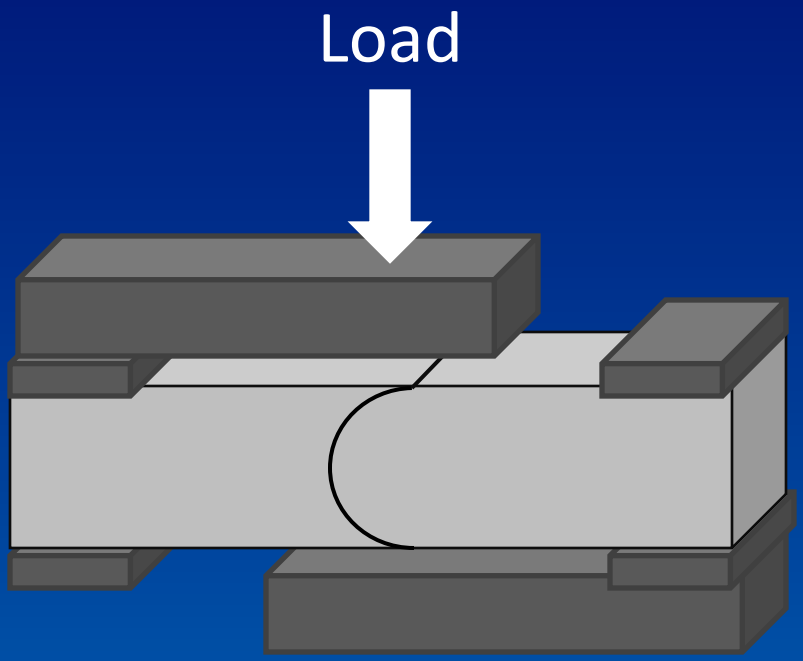
Findings

- Adhesion controls initial response
  - Stiffness
  - Strength
- Keyed trough required
- Headed studs
  - 6 in. embedment sufficient
- Connection design philosophy
  - Strength controlled by shear stud

Panel-to-Panel Connection



Test Setup



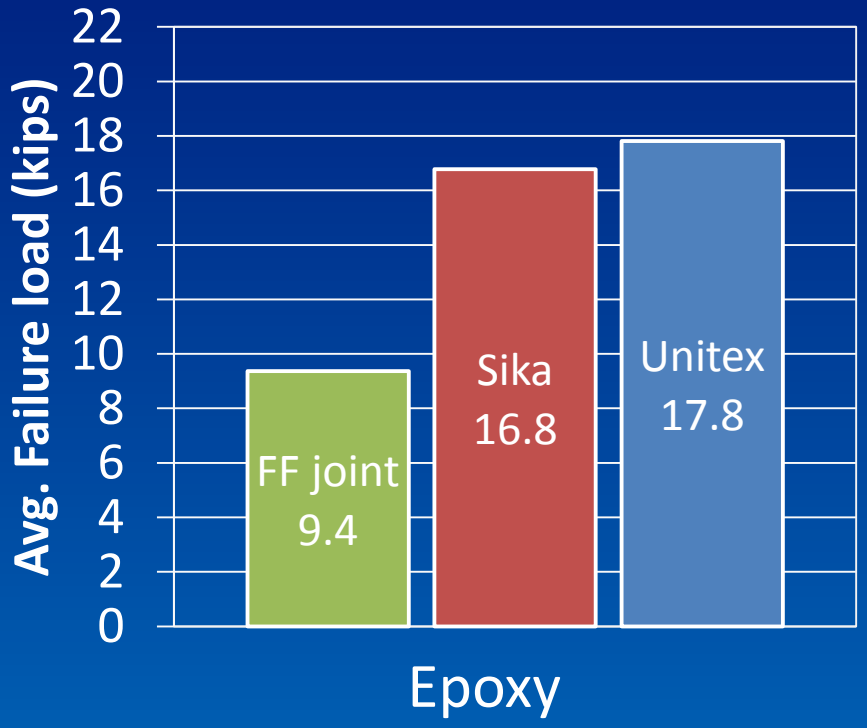
Variables

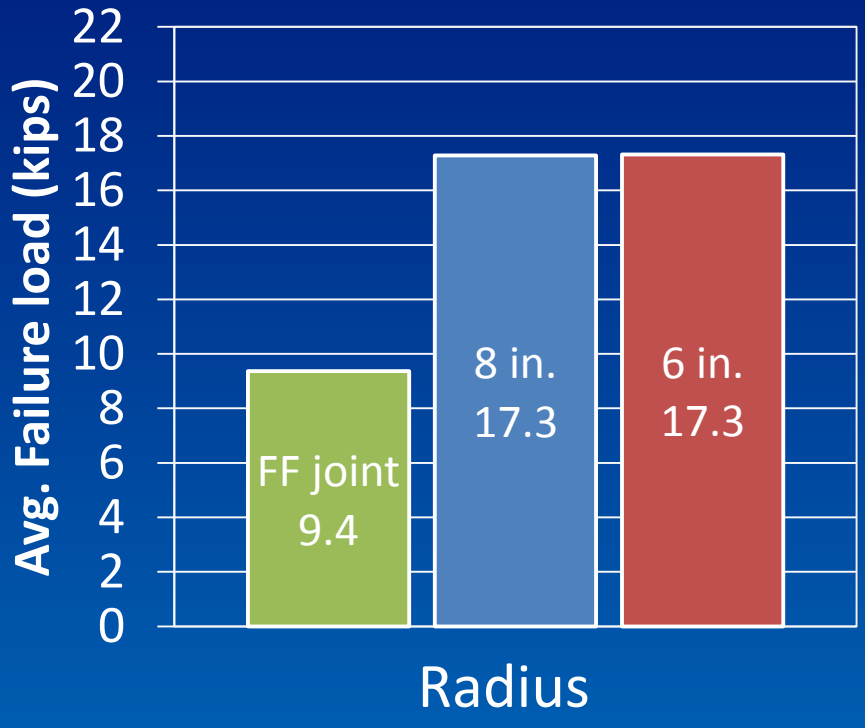
- Radius
- Epoxy

Test Specimen

New England

Test Results

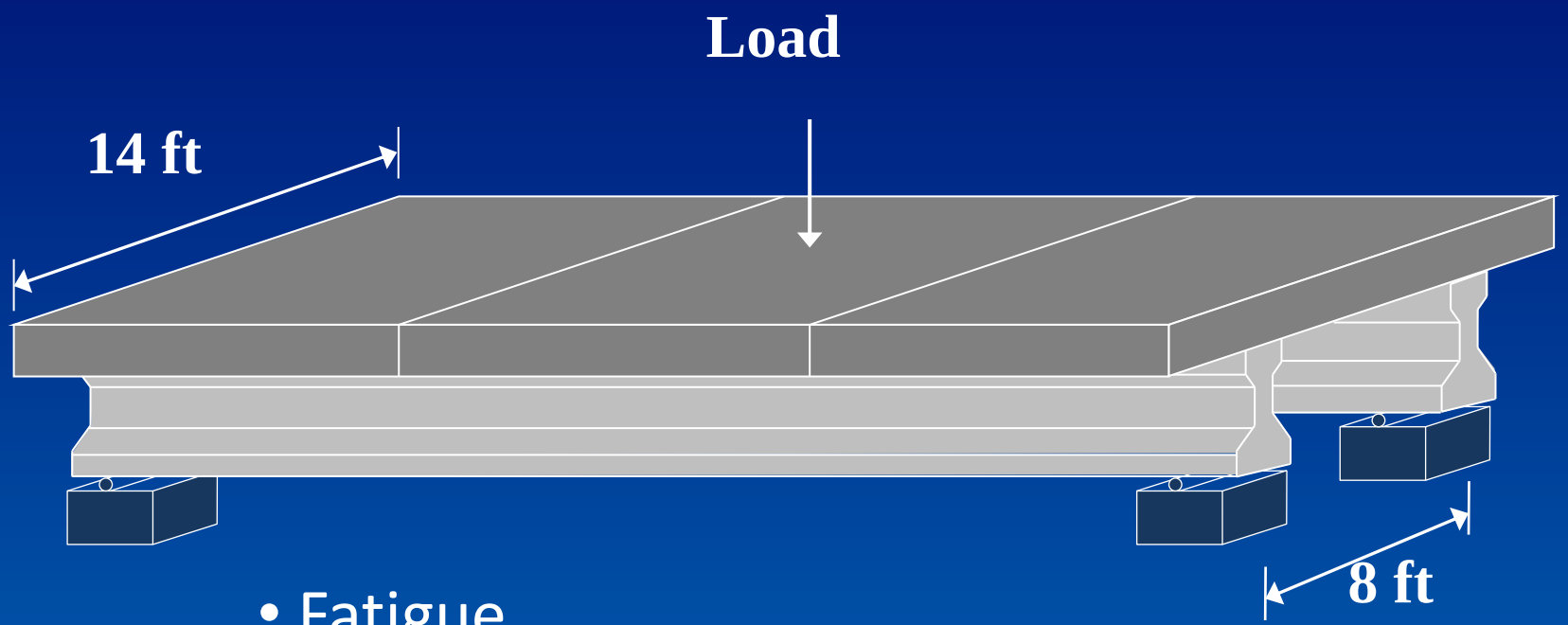




Findings

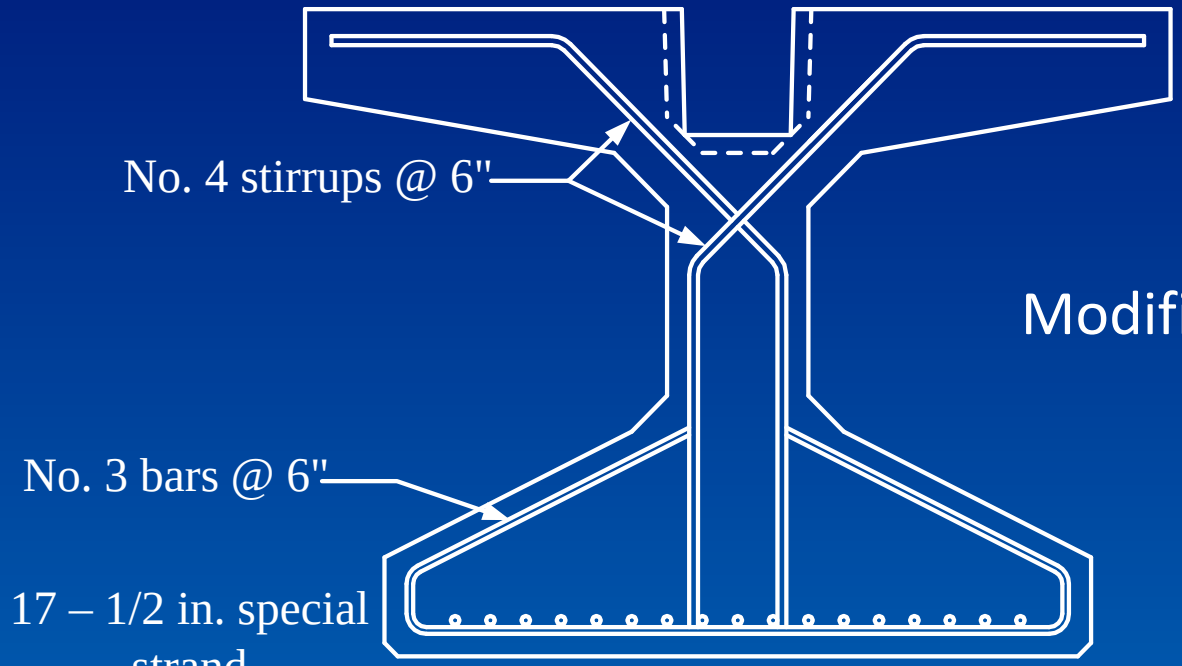
- Radius did not affect strength
- Failure strength controlled by concrete
- Both epoxies had similar performance
- New joint design had improved
  - Behavior
  - Strength

Prototype Bridge



- Fatigue
- Connection Shear Strength

Girder Reinforcement



Modified HN 36 49

Steel Section

Girder Construction

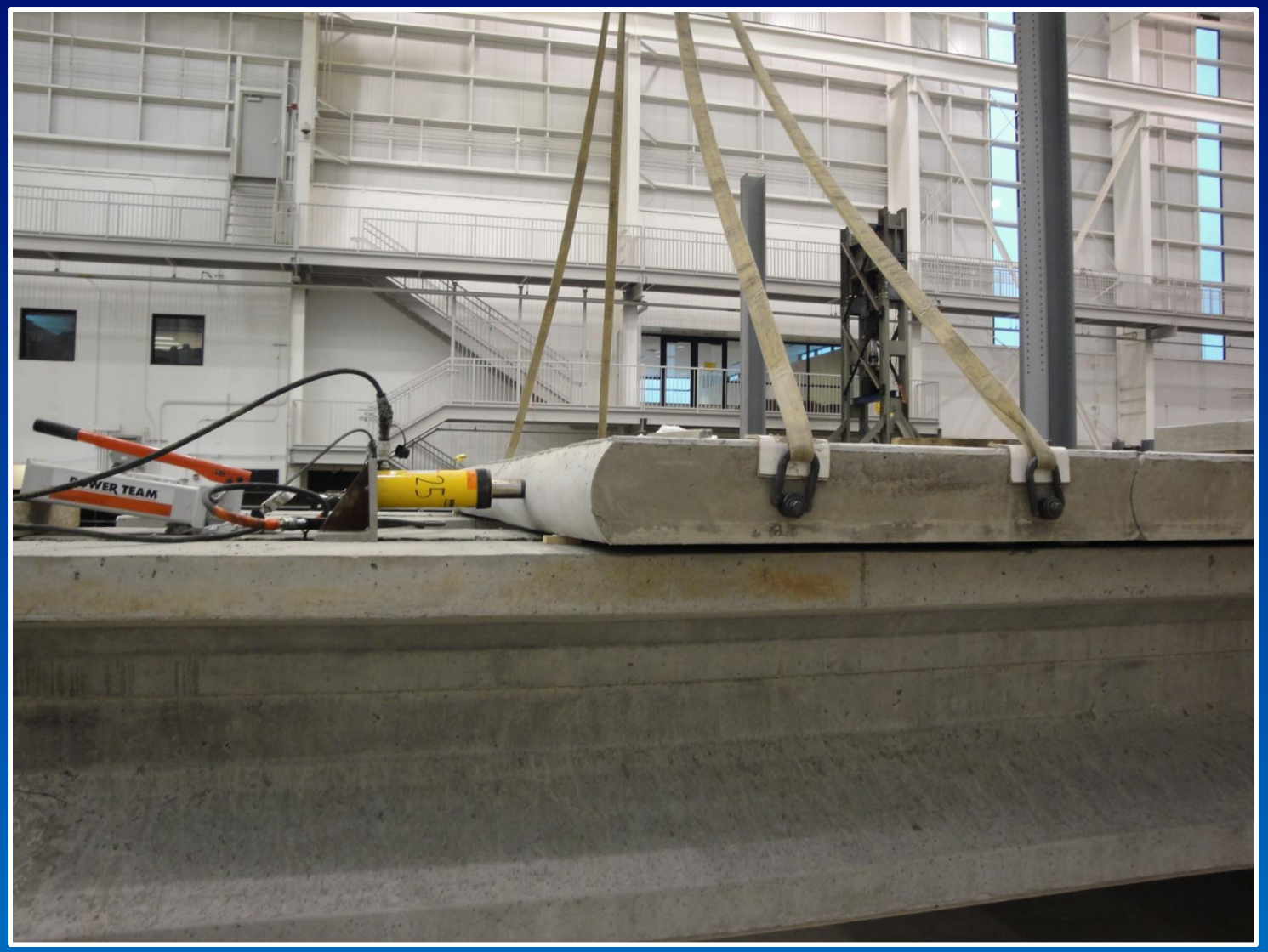
Completed Girders

Panel Construction

Prototype System

Details

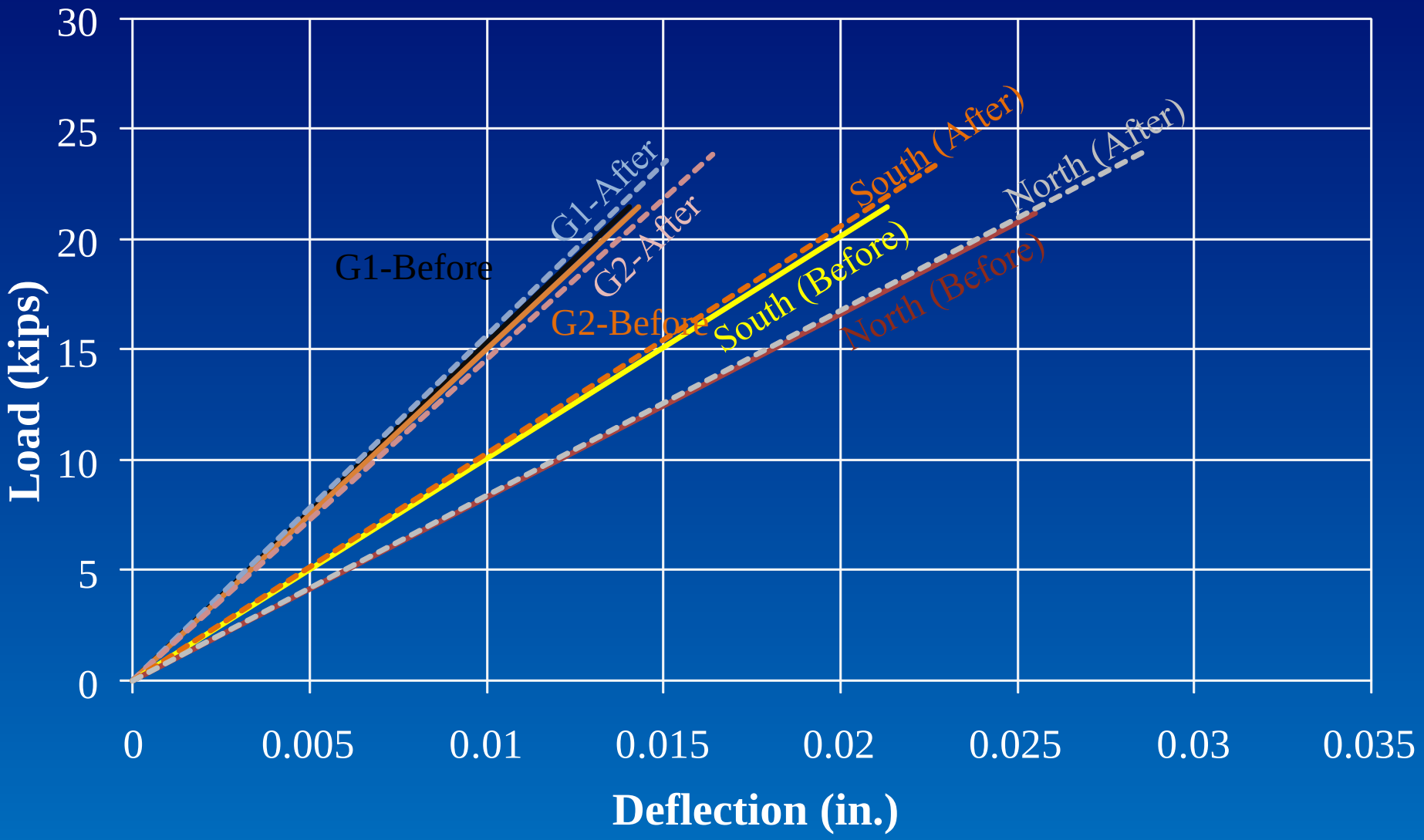
Specimen Construction



Cyclic Load

Elevation (front)

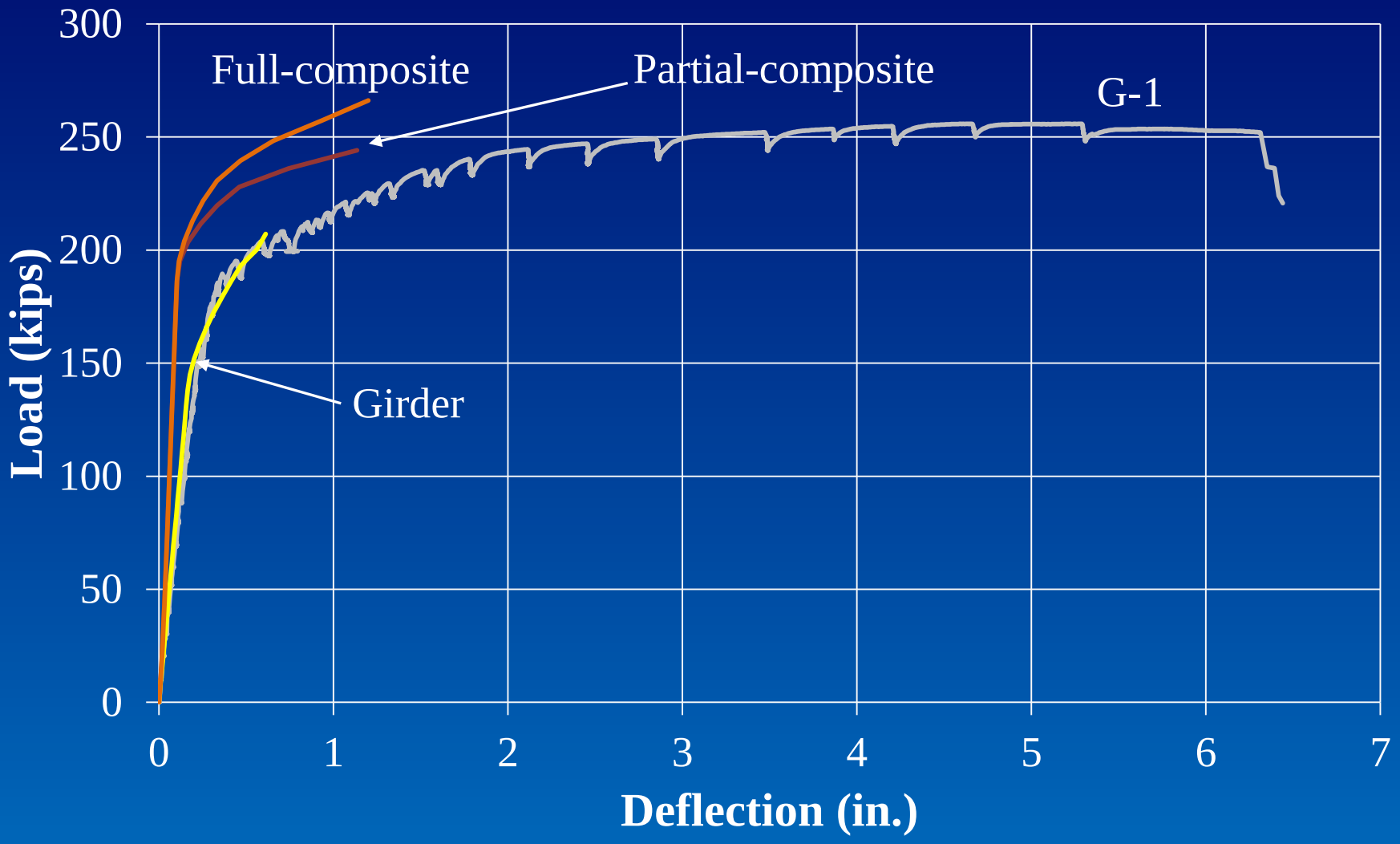
Cyclic Load Results – 2M cycles



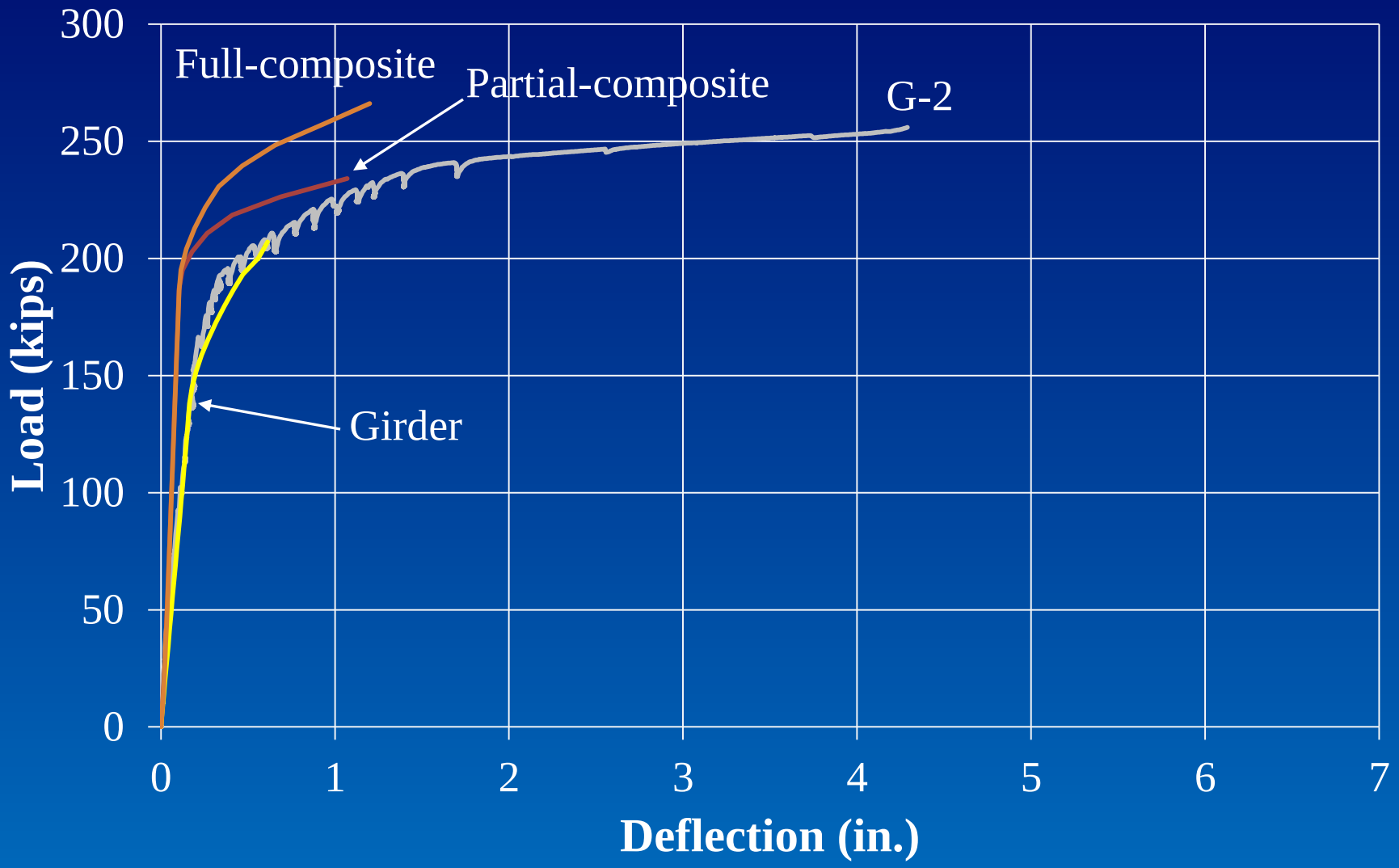
Static Load

Elevation (front)

Static Load Test Results (G-1)



Static Load Test Results (G-2)



Summary

- Demonstrated ease in constructability
  - Precaster
  - 30 man hours
  - Trough width
- Cyclic loading – Transverse joint
- Ultimate loading – Panel-to-girder joint
- Excellent performance

Conclusions

- New system developed
  - Design and detailing recommendations
- Significant advantages
  - Increased durability
  - Increased speed of construction

Acknowledgments